Corps Planning CoP Conf

“Shared Vision Planning”: Collaborative Analytical Planning LOSLR Case Study

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International Lake Ontario - St. Lawrence River Study

Overview

- Evolution of US water resources planning principles
- “Shared Vision Planning”
- International Joint Commission (IJC)
- LOSLR Study link to Corps planning (basically a reservoir reallocation – re-regulation planning exercise to incorporate new interests – envir, rec boat, riparians/shoreline)

Unique Features of LOSLR Study

- Binational, multiagency **(US/Canada study sponsors)**
- **Independent** advisory Board to IJC
- **Independent** Public Interest Advisory Group
- ***No IJC procedures or guidelines for planning***
- Budget from DoS and Min Foreign Affairs
- Budget allocation decisions by Study Board
- Applied **Shared Vision Planning** approach developed by IWR – reviewed by NAS/NRC as "state of the art" application
- **Applied many collaborative planning principles & analytical methods developed by Corps (see EC 1105-2-409)**

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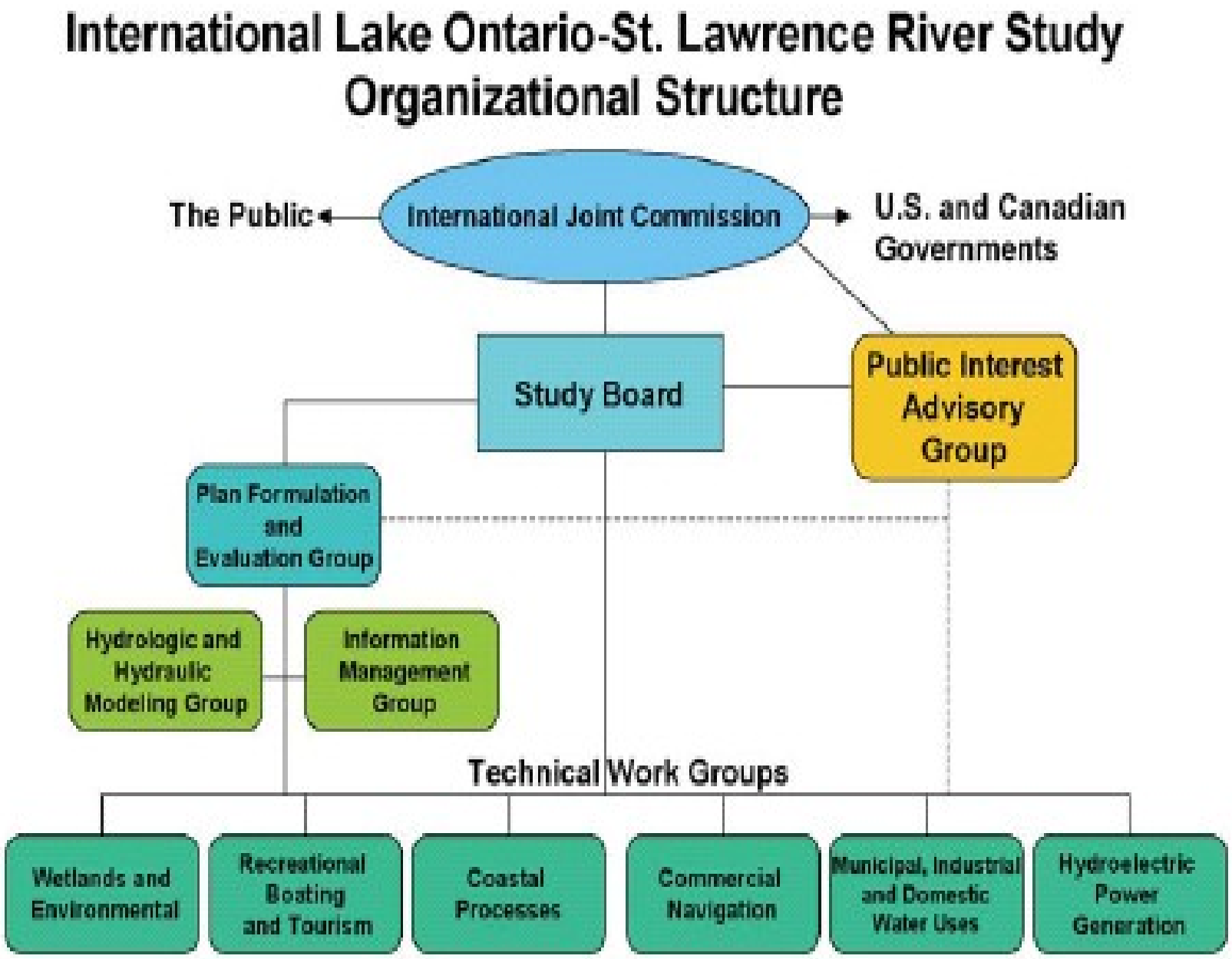
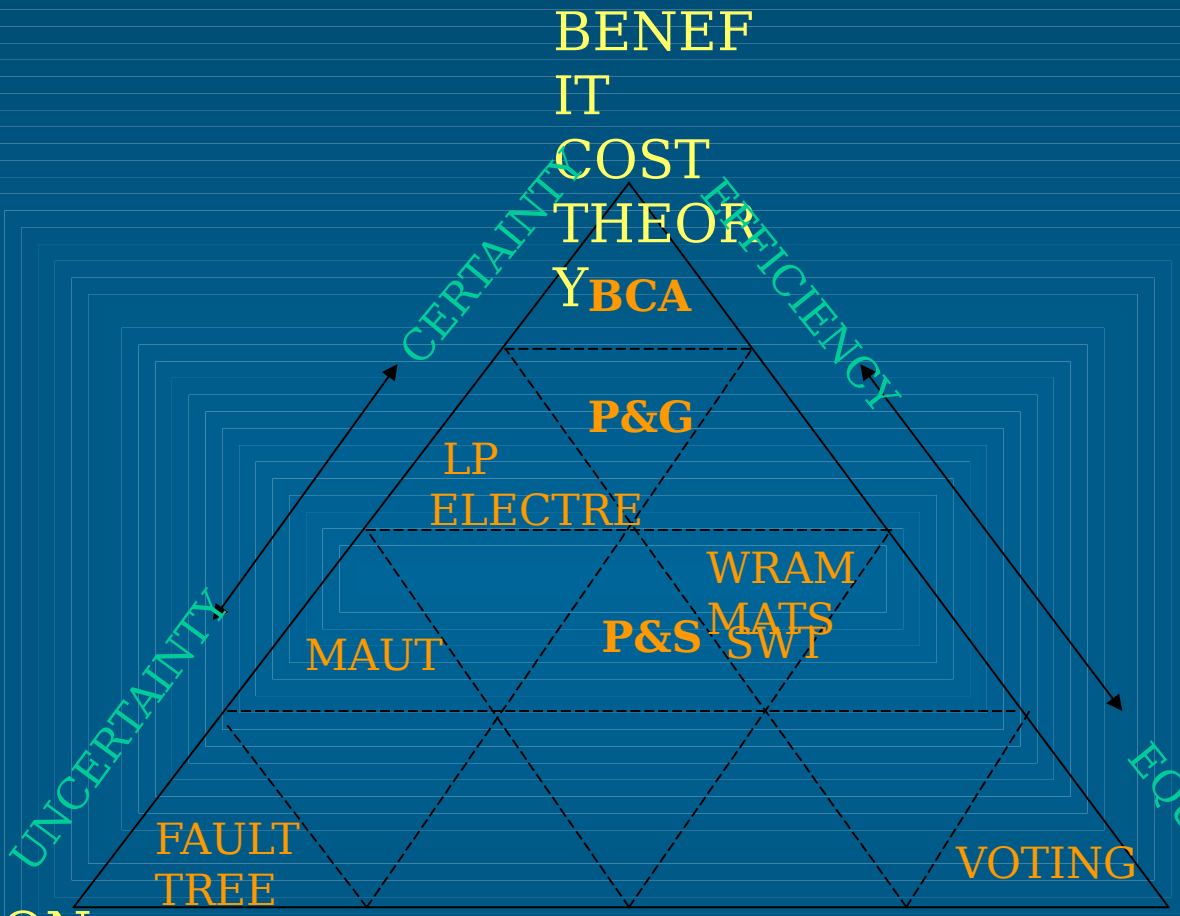


Figure 4. Study Organization

Basic Planning/Evaluation Philosophies

- Descriptive (to classify, rather than explain; no normative decision rules e.g NOAA's CZM planning guidelines)
- ***Indicative*** (to demonstrate the need for; uses BCA, formal normative decision rules, replicable, P&S/P&G)
- Prescriptive (to establish as rule or law; standards, targets, criteria – TMDL's, water quality, engrg design standards)
- Proscriptive (to prohibit; most regulatory programs)
- "Ersatz" (environmental restoration sitting around the table zeitgeist; whatever sticks to the wall & we all feel good)
- "Garbage Can" (whatever the clients want, and they set the rules for analysis)

Normative Evaluation Philosophies



DECISION THEORY

SINGLE DM

MULTIPUBLIC

SOCIAL CHOICE THEORY

P&S/P&G Impact Accounting System

- **National Economic Development (NED)**
  - beneficial and adverse effects on the national economy in monetary terms
- **Environmental Quality (EQ)**
  - effects of plans on significant environmental resources and ecological, cultural and esthetic attributes
- **Regional Economic Development (RED)**
  - distribution of regional economic activity from each plan in terms of regional income and employment
- **Other Social Effects (OSE)**
  - effects on urban and community impacts, life, health, safety factors; displacement, long term productivity; energy requirements and energy conservation

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OSE/SWB - Other Social Effects/ Social Well-Being

- Income distribution
- Employment distribution
- Population distribution/composition
- Fiscal condition of state & local governments
- Energy requirements/conservation
- Health, essential public services
- Safety, natural hazards
  - potential loss of life
  - property security

★ • Quality of community life

- Displacement of people, business, farms

★ • Long-term productivity of resources for use by future generations (sustainable development?)

Corps "Collaborative Planning" Regs (EC 1105-2-409 31 May, 2005)

- "… facilitate, convene, and advise…work collaboratively …in developing solutions that integrate programs, policies and projects across public agencies."
- "Any alternative plan may be selected …if it has, on balance, net beneficial effects…in the four P&G accounts"
- "Mitigation Planning is an integral part of the process…"
- Adaptive management takes into account the uncertainties that (affect) decisions…allowing project performance to be assessed and evaluated (and necessary adjustments).
- External peer review is is necessary for quality and credibility of the science inputs.

EC 1105-2-409, Cont'd

- "collaborative planning is…essential to the success of watershed scale planning."
- "Collaborative planning also includes Corps participation …in other Federal, state, or local planning activities…"
- Each planning report will identify the following types of plans:

➢ Locally preferred plans
➢ National interest plans
➢ Nonstructural plans (policies, incentives, institutional, etc.)

How does one evaluate these plans? How does one choose a plan that is in the "public/federal interest"?

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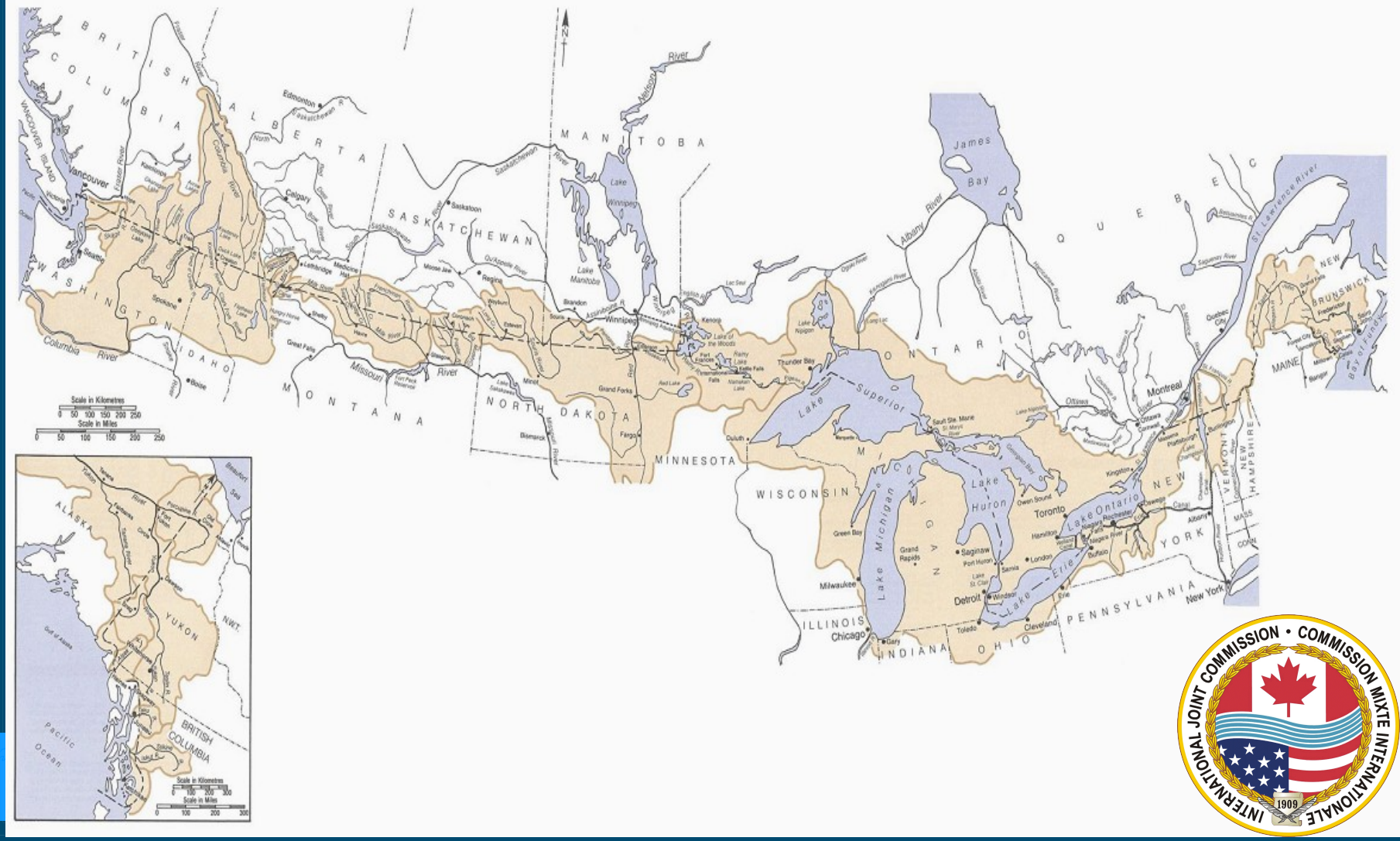
IJC OVERSEES CANADA-US TRANSBOUNDARY WATER COAST TO COAST



IJC Boards and Task Forces

BOARDS of CONTROL/COMBINED BOARDS/POLLUTION BOARDS

- International St. Lawrence River Board of Control
- International Niagara River Board of Control
- International Lake Superior Board of Control
- International Osoyoos Lake Board of Control
- International Rainy Lake Board of Control
- International Rainy River Pollution Advisory Board
- International Lake of the Woods Board of Control
- International Kootenay Lake Board of Control
- International Columbia River Board of Control
- International Air Quality Advisory Board
- International Red River Board
- International St. Croix River Board
- International Souris River Board
- St. Mary-Milk Rivers Accredited Officers

GREAT LAKES WATER QUALITY

- Great Lakes Water Quality Board
- Great Lakes Science Advisory Board
- Council of Great Lakes Research Managers

INVESTIGATIVE BODIES

- Health Professionals Task Force
- **Lake Ontario-St. Lawrence Study Board**
- St. Mary-Milk Rivers Administrative Task Force

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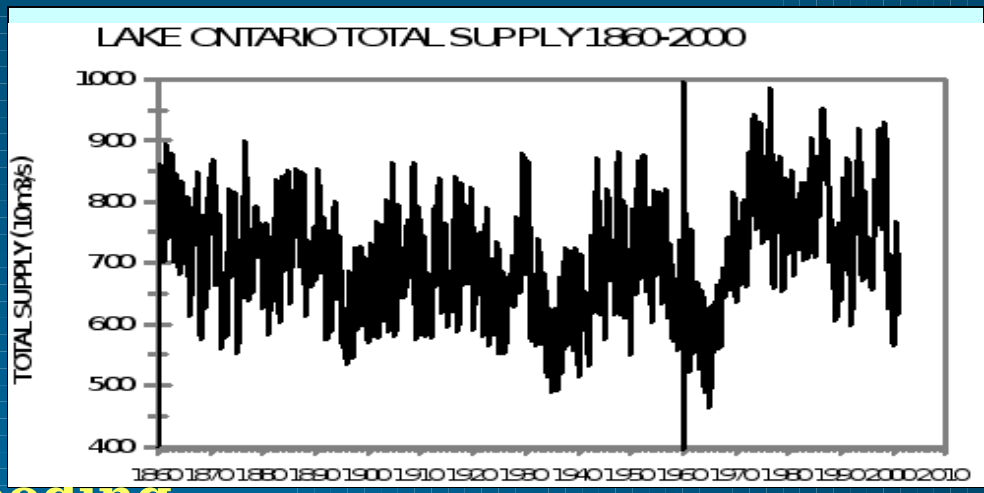
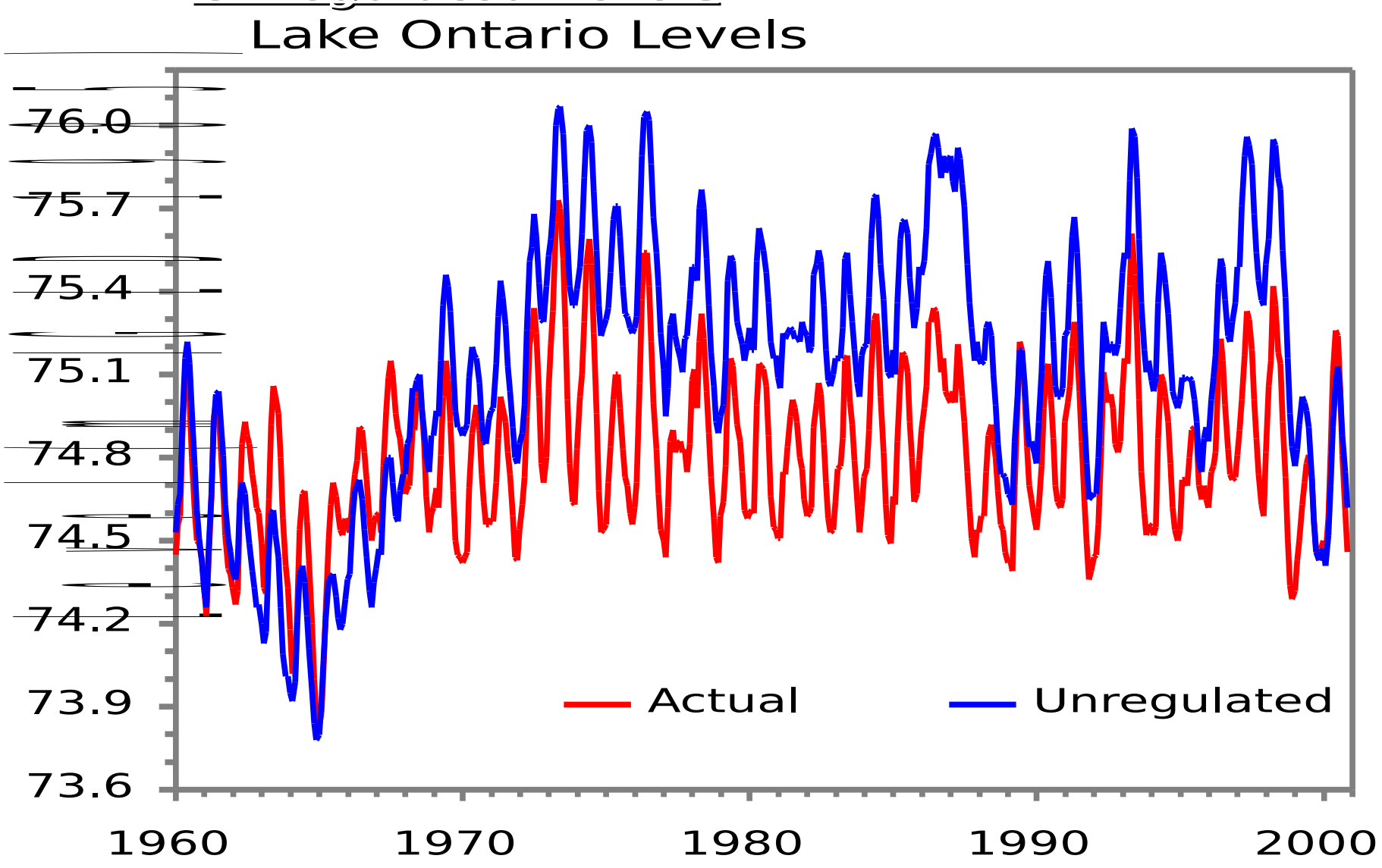
Changing Great Lakes Water Levels

- **Water Level Shifts**
  - Highs - 70s-90's
  - Lows - 60's, 1998-2001
- **Impacts**
  - **High Levels**
    - Shoreline Erosion – Flooding
  - **Low Levels**
    - Hydropower - Navigation - Recreational Boating - Environment
- **Actions – Review of IJC Orders**
  - $20 Million St. Lawrence-Ontario Stud
  - Proposed Upper Lakes Study



Unknown - Climate C

Comparison of Actual and Unregulated Levels



We Studied the Effects of Fluctuating Water Levels on:

- Water intakes and outfalls
- Hydroelectric power production
- Commercial navigation

- *The ecosystem*
- *Recreational boating and tourism*
- *Coastal flooding & erosion impacts*

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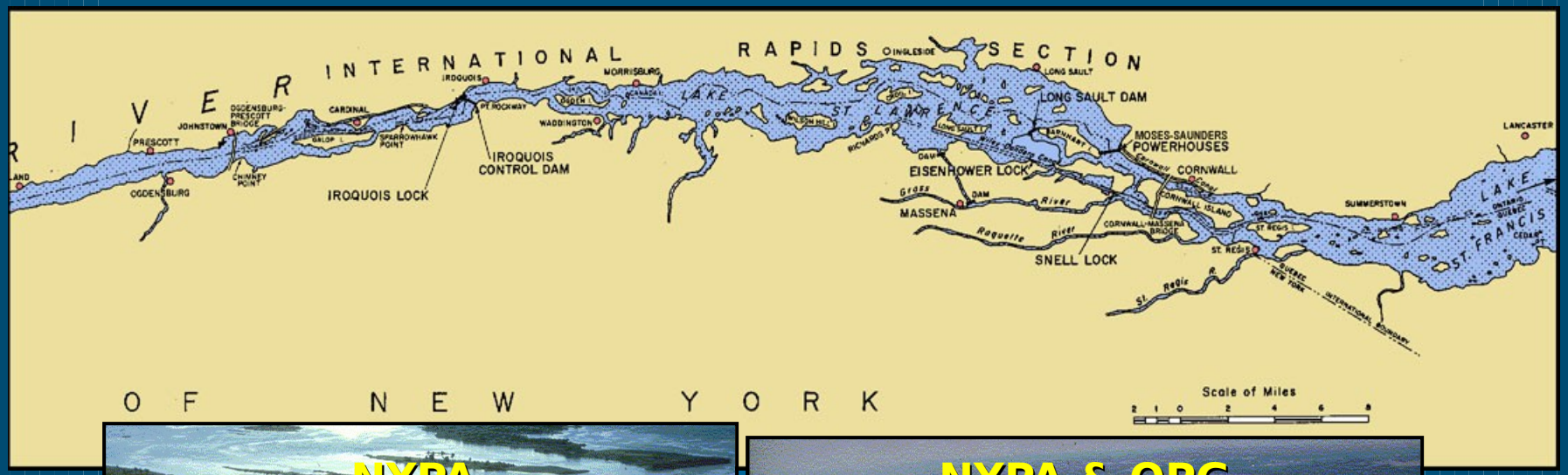
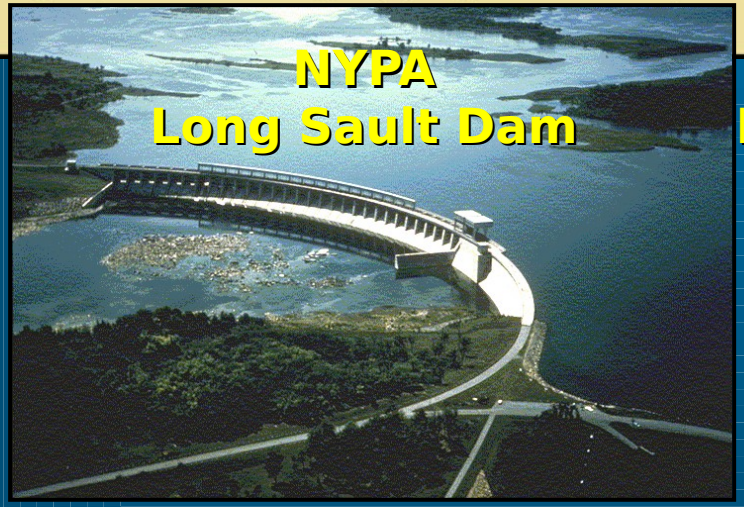
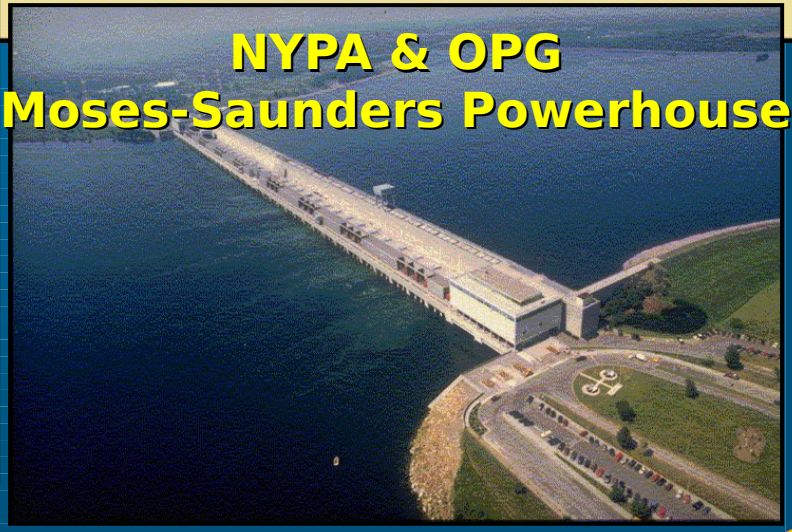
Control Structures in the International Reac







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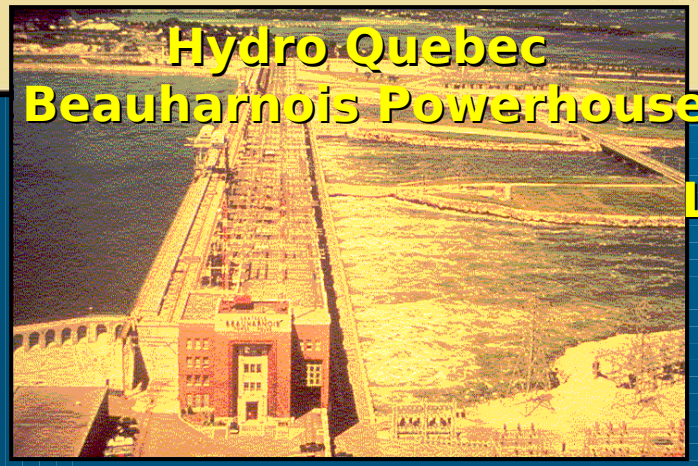
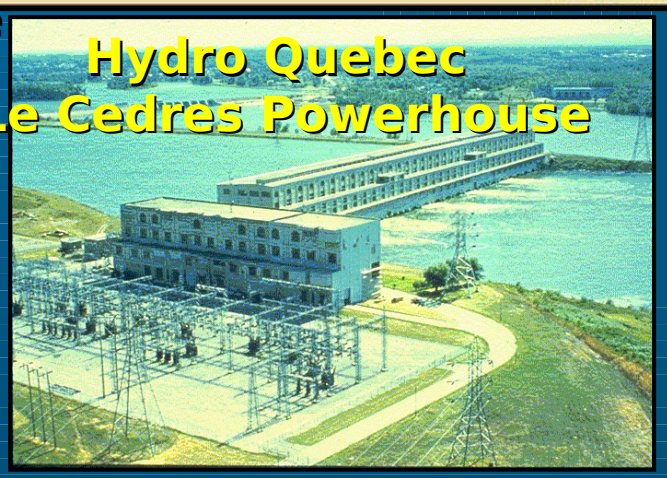
INTERNATIONAL JOINT COMMISSION • COMMISSION MIXTE INTERNATIONALE
1909

Control Structures in the All-Canadian Reach





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What's "Shared Vision Planning" ?

- An implementation of WRC/Corps planning process & **evaluation principles**, without the rigidity of regs
- Simulation modeling to construct quick scenarios, describe system state to better understand hydraulic, hydrologic responses & potential impacts – a 'get to know the system tool' – getting lots of people on the same page quickly
- much more public participation and frequent joint iterative plan formulation – transparent, replicable analysis
- Earlier introduction of incomplete technical information and simulation of preliminary ideas and plans
- Frequent *'exercising'* evaluation and decisionmaking by Board and PIAG – "Board Room" website

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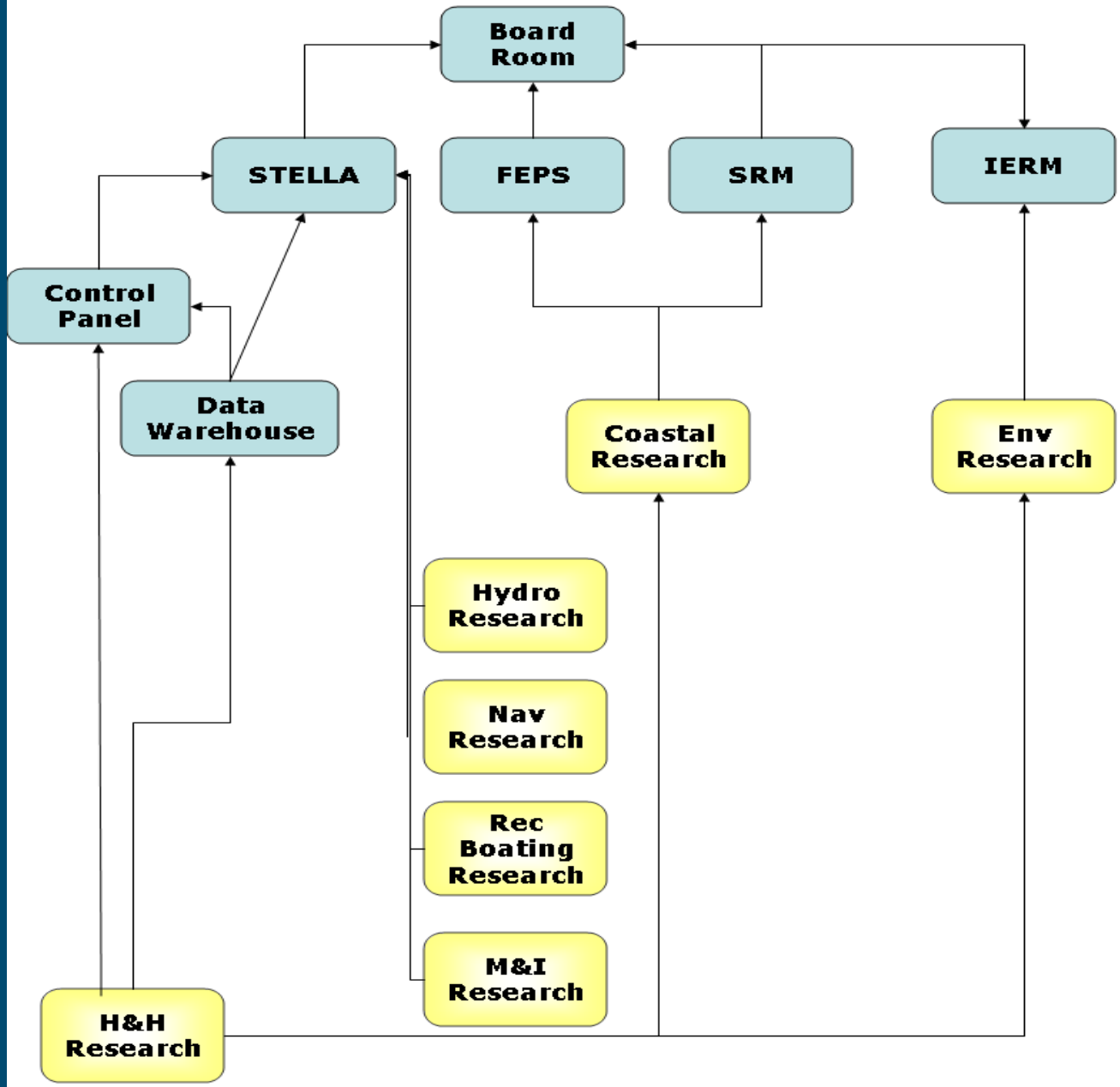
The Shared Vision Model



Abbreviations

STELLA – Model programming software

FEPS – Flood and Erosion Prediction System

SRM – St. Lawrence River Model

IERM – Integrated Ecological Response Model

H&H – Hydrology and Hydraulics

Env – Environment

Hydro – Hydropower

Nav – Commercial Navigation

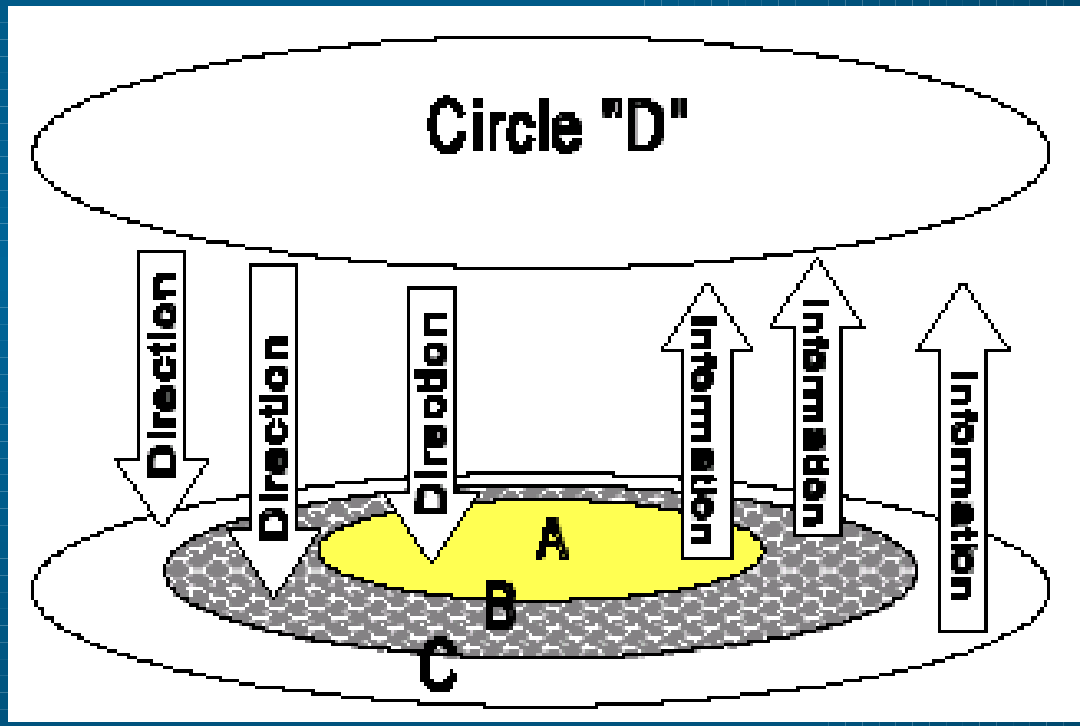
Rec – Recreational Boating

M&I – Municipal,

"Shared Vision Planning" Foundations:

Public Involvement – > 500 active participants, NGO's
2500 at public meetings, 10,000 newsletter

- "Circles of influence" concepts promote team building
- Concentric circles linked through existing networks – ***win the trust of the trusted***



Circle A – Model Building team

Circle B – Model Users

Circle C – All interested parties

Circle D – Political Decision

LOSLR Study Guidelines (Objectives)

- Contribute to **Ecological Integrity**
- **Maximize economic and ecological net benefits**
- No **disproportionate loss (Equity)**
- Flexible in recognition of **unusual or unexpected** conditions
- Adaptable to **climate change** and **climate variability**.
- Decision-making will be **transparent and representative**
- **Adapt** to future advances in knowledge, science and technology

Performance Indicators (PI's)

- Over 500 ***initial*** PI's & hydrologic & hydraulic criteria covering ecosystem, navigation, erosion, flooding, M&I water, hydropower, recreational boating
- Winnowed to 81 PI's, incl 32 Ecol PI's for evaluation/decisionmaking

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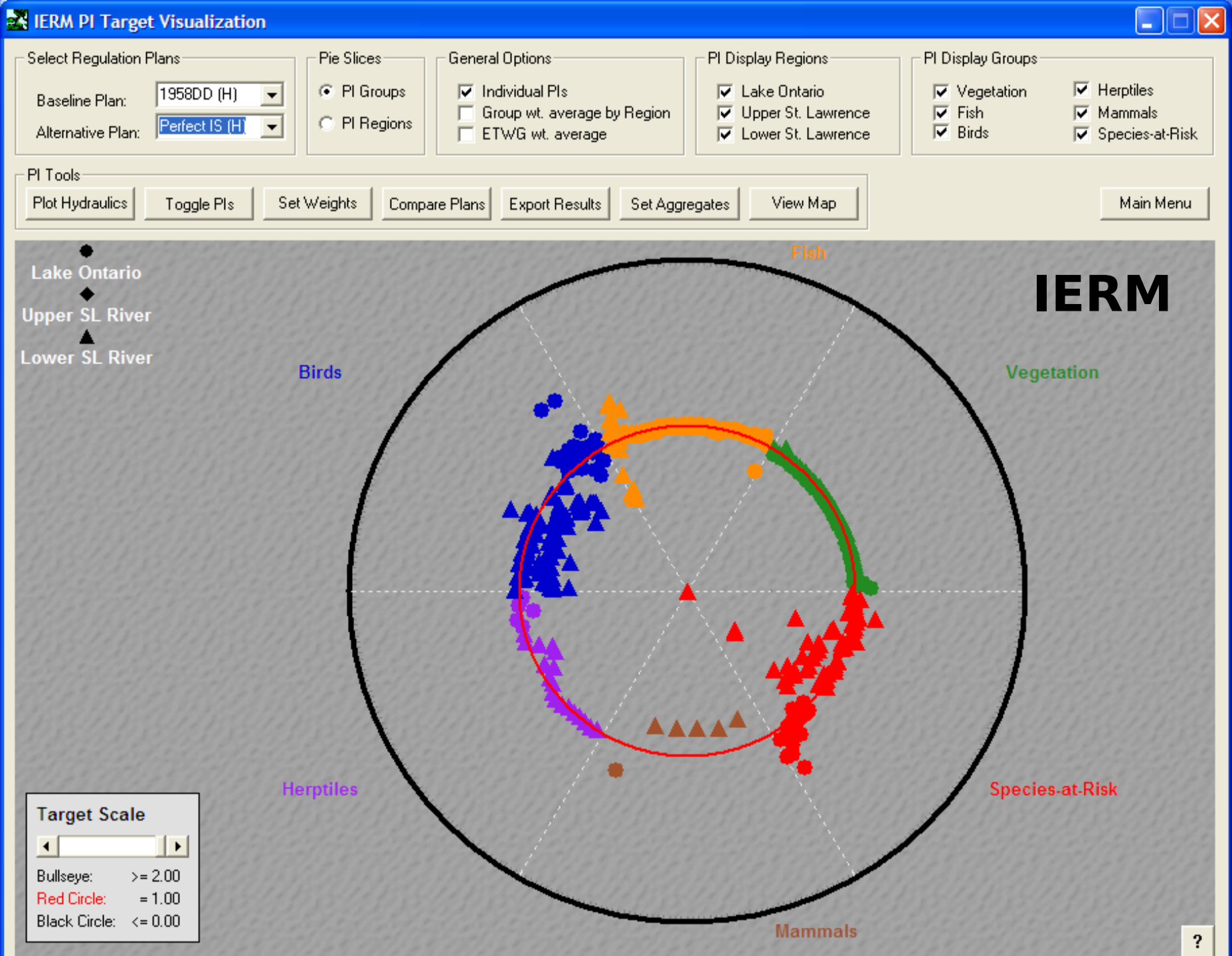
Goal ⇒ Objective ⇒ Criteria	Sustainable Development				Reduce Vulnerability	
	Econ.	Envir.	Equity	SWB	Safety	Reliability
Mgmt. Measure	$ Costs & Benefit	W.Q. Habitat Diversity	Income Distribution	Relocate	Population at Risk	Frequency of Failure
MM_1						
…						
MM_i						
…						
MM_n						

Management ⇒ (Adaptive) Measures

- Structural / infrastructure
- Legal / legislative
- Institutional / administrative
- Regulations (land use, zoning, standards)
- Education
- Financial incentives, subsi
- Taxes, tariffs, user fees (-)
- Research and development
- Market mechanisms
- Technology development


IERM PI Target Visualization
Select Regulation Plans
Baseline Plan:
1958DD (H)
Alternative Plan:
Perfect IS (H)
Pie Slices
PI Groups
PI Regions
General Options
Individual PIs
Group wt. average by Region
ETWG wt. average
PI Display Regions
Lake Ontario
Upper St. Lawrence
Lower St. Lawrence
PI Display Groups
Vegetation
Fish
Birds
Herptiles
Mammals
Species-at-Risk
PI Tools
Plot Hydraulics
Toggle PIs
Set Weights
Compare Plans
Export Results
Set Aggregates
View Map
Main Menu
Lake Ontario
Upper SL River
Lower SL River
IERM
Fish
Birds
Vegetation
Herptiles
Species-at-Risk
Mammals
Target Scale
Bullseye: >= 2.00
Red Circle: = 1.00
Black Circle: <= 0.00
?

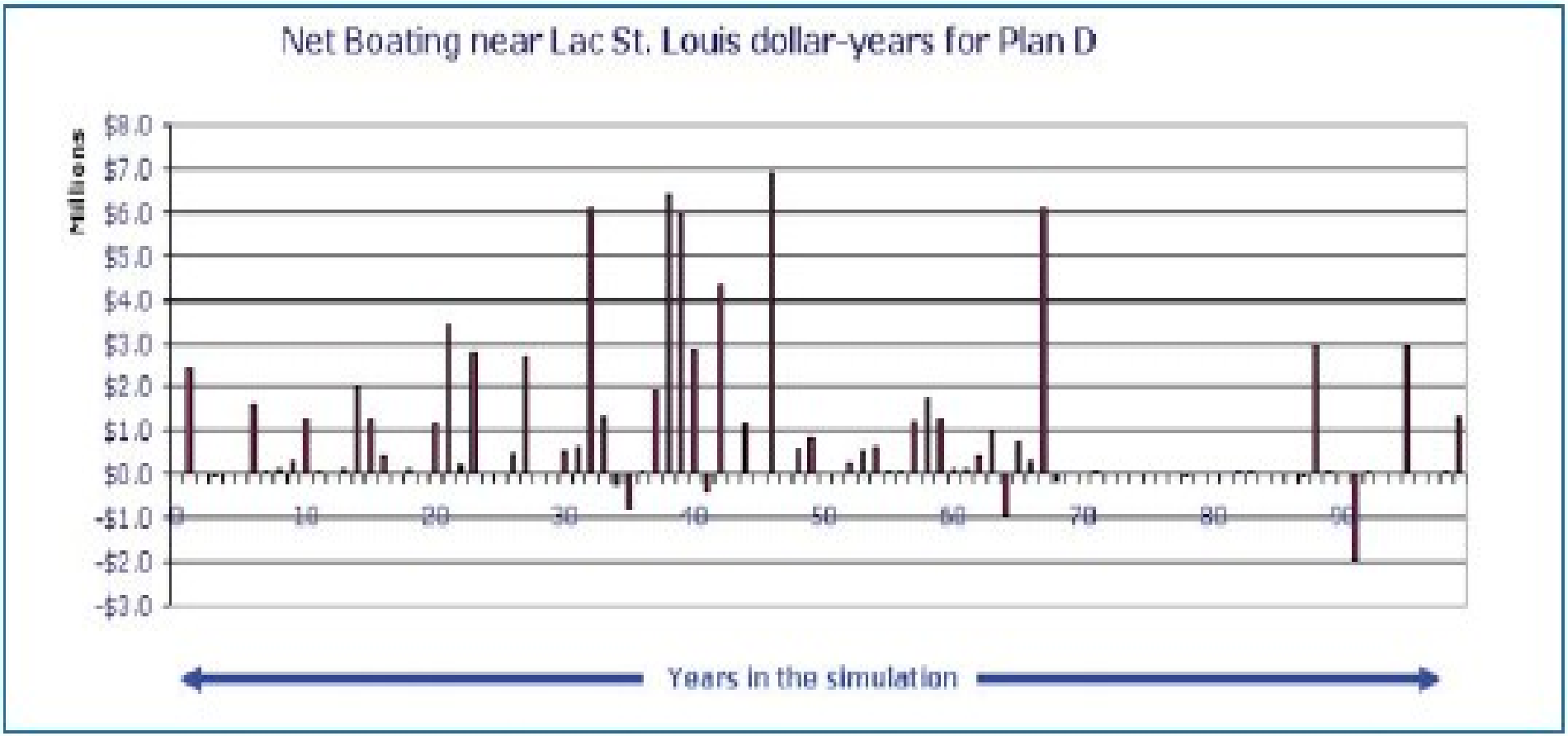


Figure 36: Net economic benefits over the 101-year historical sequence for Plan D+ at Lac St. Louis

IERM Performance Indicator Time Series Results

Select Regulation Plans

Baseline Plan: 1958DD (H) ☑ Plot

Alternative Plan: E (H) ☑ Plot

PI Overview

Region: Group:

Least Bittern (IXEX) - reproductive index (Lake Ontario) (index)

PI Aggregate Scores

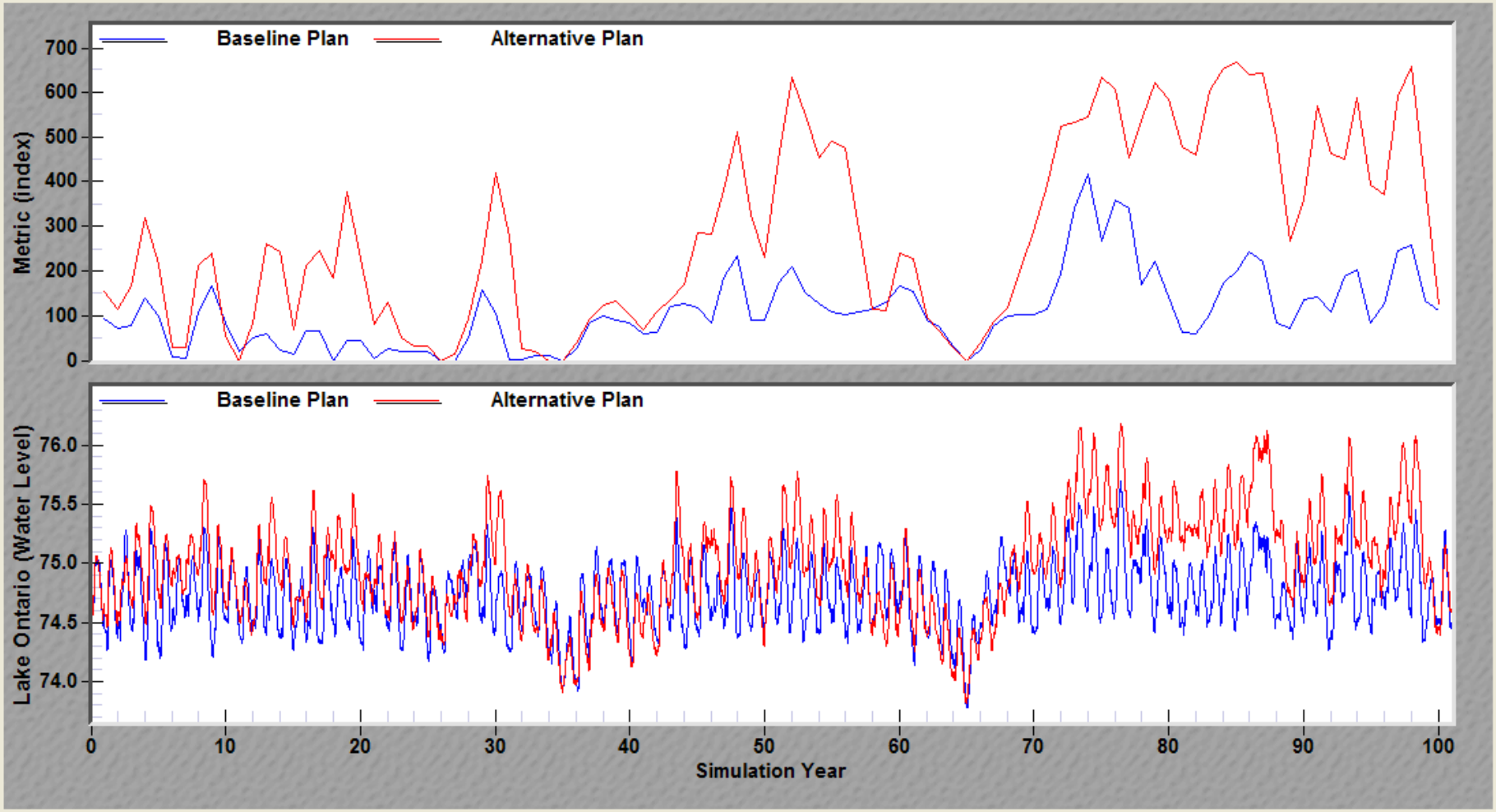
Ratio: 1.133

Baseline: 0.750

Alternative: 0.850

Zoom

Zoom Extent



PI Tools

Plot Group | Export Results | PI Browser

?

<< Back

Progression of Plan Evaluation/Selection

(with 500 active participants/NGOs)

October 2004 Workshop: A B C D E F G H I J K.....

March 2005 Workshop: A B C D E OntRip RecBtg

April 2005 Workshop: A B C D E + Ref. Plans

Final Plans: A, B, D + Reference Plans

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Candidate Plans:

- A: Balanced Economics
- B: Balanced Environmental
- D: Blended Benefits

Natural Flow Plan

- E: Natural Flow

Interest Specific:

- Ontario Riparian Plan
- Recreational Boating Plan

Reference Plans:

- Plan 1998
- Plan 1958DD
- Plan 1958D

Net Economic/Ecologic Benefits of Alternative Plans

Avg. annual net benefits ($US million)	Plan 1958D D	Plan A	Plan B	Plan D	Plan E
Net Benefits	**0.00**	**7.52**	**6.48**	**6.52**	**-12.30**
Shoreline Damages	0.00	**-0.62**	**-1.11**	**0.32**	**-25.96**
Navigation	0.00	0.41	2.20	2.31	4.13
Recreation Boating	0.00	4.23	-0.58	2.04	**-4.64**
Hydroelectric	0.00	3.50	5.97	1.82	14.16
Municipal Water	0.00	0.00	0.00	0.00	0.00
Environmental Index	**1.00**	**1.06**	**1.35**	**1.10**	**4.04**
Wetlands Index	**1.00**	**1.02**	**1.44**	**1.17**	**1.56**

Economic Robustness of Plans w.r.t Climate Change Scenarios

Avg. ann. net benefits ($US million)	Plan 1958D	Plan A	Plan B	Plan D	Plan E
Plan 1958DD	0	7.52	6.48	6.52	-12.30
C1- Hot/Dry	-115.65	34.89	-1.42	20.09	-4.91
C2 - Warm/Dry	-49.52	9.85	4.89	5.25	-34.03
C3 - Hot/Wet	-81.69	21.53	2.61	17.77	-2[illegible]6
C4 - Warm/Wet	13.98	8.33	11.78	9.65	-21.38

Average Annual Net Discounted Benefits	Plan A+	Plan B+	Plan D+	Plan E
Total	**$6.44**	**$4.63**	**$4.48**	**-$16.36**
COASTAL	**-$0.10**	**-$2.84**	**-$0.10**	**-$28.50**
Lake Ontario	*$0.46*	*-$2.52*	*-$0.23*	*-$27.16*
Shore Protection Maintenance[2]	$0.57	-$2.16	-$0.17	-$19.85
Erosion to Unprotected Developed Parcels[2]	-$0.23	-$0.17	$0.02	-$0.58
Flooding	$0.12	-$0.20	-$0.08	-$6.72
Upper St. Lawrence River	*$0.01*	*-$0.01*	*-$0.01*	*-$0.75*
Flooding	$0.01	-$0.01	-$0.01	-$0.75
Lower St. Lawrence River	*-$0.57*	*-$0.31*	*$0.14*	*-$0.59*
Flooding	-$0.51	-$0.22	$0.09	-$0.49
Shore Protection Maintenance[3]	-$0.06	-$0.09	$0.05	-$0.10
COMMERCIAL NAVIGATION	**$0.47**	**$2.13**	**$1.53**	**$3.21**
Lake Ontario	-$0.03	-$0.01	-$0.01	-$0.02
Seaway	$0.57	$2.16	$1.56	$3.21
Montreal down	-$0.07	-$0.02	-$0.02	$0.02
HYDROPOWER	**$2.26**	**$6.09**	**$1.64**	**$12.39**
NYPA-OPG (Energy$ + Peaking$)	$2.18	$3.87	$0.48	$8.57
Hydro Quebec (Energy $)	$0.08	$2.22	$1.16	$3.82
RECREATIONAL BOATING	**$3.81**	**-$0.74**	**$1.42**	**-$3.46**
Above Dam	*$1.20*	*-$1.42*	*-$0.36*	*-$5.31*
Lake Ontario	$0.70	-$1.18	-$0.44	-$4.93
Alex Bay	$0.47	-$0.29	$0.03	-$0.36
Ogdensburg	$0.01	$0.00	$0.01	-$0.07
Lake St. Lawrence	$0.01	$0.05	$0.05	$0.05
Below Dam	*$2.61*	*$0.68*	*$1.78*	*$1.85*
Lac St. Louis	$1.39	$0.49	$0.89	$1.03
Montreal	$0.93	$0.19	$0.68	$0.64
Lac St. Pierre	$0.29	$0.00	$0.21	$0.18
M&I	**$0.00**	**$0.00**	**$0.00**	**$0.00**
SL One-time Infrastructure Costs	$0.00	$0.00	$0.00	$0.00
LSL Water Quality Investments	$0.00	$0.00	$0.00	$0.00

Notes to Table 6:

1. Figures reflect the average annual impact relative to Plan 1958-DD and are reported in millions of U.S. dollars. **Blue** represents a positive net benefit relative to 1958-DD and **red** indicates a negative net benefit relative to 1958-DD.
2. These are economic results based on the 50,000-year stochastic supply series, using a 4% discount rate over a 30-year period, for coastal erosion and shore protection maintenance.
3. The St. Lawrence River Model component of the Shared Vision Model could not be adapted to run the full 50,000-year stochastic series. The results presented represent an average of the historical sequence plus the four 101-year trial segments from the stochastic (S1, S2, S3 and S4 series).

Table C6: Economic results for candidate plans by interest and region based on 50,000-year stochastic supply sequence

Average Annual Net Discounted Benefits	Plan A+	Plan B+	Plan D+	Plan E
Total	**$6.44**	**$4.63**	**$4.48**	**-$16.36**
COASTAL	**-$0.10**	**-$2.84**	**-$0.10**	**-$28.50**
Lake Ontario	*$0.46*	*-$2.52*	*-$0.23*	*-$27.16*
Shore Protection Maintenance[2]	$0.57	-$2.16	-$0.17	-$19.85
Erosion to Unprotected Developed Parcels[2]	-$0.23	-$0.17	$0.02	-$0.58
Flooding	$0.12	-$0.20	-$0.08	-$6.72
Upper St. Lawrence River	*$0.01*	*-$0.01*	*-$0.01*	*-$0.75*
Flooding	$0.01	-$0.01	-$0.01	-$0.75
Lower St. Lawrence River	*-$0.57*	*-$0.31*	*$0.14*	*-$0.59*
Flooding	-$0.51	-$0.22	$0.09	-$0.49
Shore Protection Maintenance[3]	-$0.06	-$0.09	$0.05	-$0.10
COMMERCIAL NAVIGATION	**$0.47**	**$2.13**	**$1.53**	**$3.21**
Lake Ontario	-$0.03	-$0.01	-$0.01	-$0.02
Seaway	$0.57	$2.16	$1.56	$3.21
Montreal down	-$0.07	-$0.02	-$0.02	$0.02
HYDROPOWER	**$2.26**	**$6.09**	**$1.64**	**$12.39**
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RECREATIONAL BOATING	**$3.81**	**-$0.74**	**$1.42**	**-$3.46**
Above Dam	*$1.20*	*-$1.42*	*-$0.36*	*-$5.31*
Lake Ontario	$0.70	-$1.18	-$0.44	-$4.93
Alex Bay	$0.47	-$0.29	$0.03	-$0.36
Ogdensburg	$0.01	$0.00	$0.01	-$0.07
Lake St. Lawrence	$0.01	$0.05	$0.05	$0.05
Below Dam	*$2.61*	*$0.68*	*$1.78*	*$1.85*
Lac St. Louis	$1.39	$0.49	$0.89	$1.03
Montreal	$0.93	$0.19	$0.68	$0.64
Lac St. Pierre	$0.29	$0.00	$0.21	$0.18
M&I	**$0.00**	**$0.00**	**$0.00**	**$0.00**
SL One-time infrastructure costs	$0.00	$0.00	$0.00	$0.00
LSL Water Quality Investments	$0.00	$0.00	$0.00	$0.00

Table 7: Percent Damage by Performance Indicator Relative to an Economic Baseline

Performance Indicator	Plan A+	Plan B+	Plan D+	Plan E
COASTAL	**0%**	**-3%**	**0%**	**-27%**
Lake Ontario	*1%*	*-3%*	*0%*	*-33%*
Shore Protection Maintenance	1%	-4%	0%	-37%
Erosion to Unprotected Developed Parcels	-2%	-2%	0%	-5%
Flooding	1%	-1%	0%	-37%
Upper St. Lawrence River	*0%*	*0%*	*0%*	*-28%*
Flooding	0%	0%	0%	-28%
Lower St. Lawrence River	*-3%*	*-1%*	*1%*	*-3%*
Flooding	-4%	-2%	1%	-4%
Shore Protection Maintenance	-1%	-1%	1%	-1%
COMMERCIAL NAVIGATION	**0%**	**1%**	**1%**	**2%**
Lake Ontario	0%	0%	0%	0%
Seaway	1%	2%	1%	3%
Montreal down	0%	0%	0%	0%
HYDROPOWER	**1%**	**2%**	**0%**	**4%**
NYPA-OPG (Energy$ + Peaking$)	1%	2%	0%	3%
Hydro Quebec (Energy $)	0%	2%	1%	4%
RECREATIONAL BOATING	**1%**	**0%**	**1%**	**-1%**
Above Dam	*1%*	*-1%*	*0%*	*-2%*
Lake Ontario	0%	-1%	0%	-3%
Alex Bay	4%	-3%	0%	-3%
Ogdensburg	0%	0%	0%	0%
Lake St. Lawrence	0%	1%	1%	1%
Below Dam	*7%*	*2%*	*5%*	*5%*
Lac St. Louis	8%	3%	5%	6%
Montreal	8%	2%	6%	5%
Lac St. Pierre	3%	0%	2%	2%
M&I	**0%**	**0%**	**0%**	**0%**
SL One time infrastructure costs	0%	0%	0%	0%
LSL Water Quality Investments	0%	0%	0%	0%

Notes to Table 7:

1. Figures represent percent impact of the average annual impact relative to Plan 1958-DD shown in Table 6 in relation to an economic baseline established for each economic performance indicator (refer to the Technical Work Group summaries in Annex 2). **Blue** represents a positive impact and **red** indicates a negative impact relative to 1958-DD.
2. The baseline numbers used to derive the percentages are rough but consistently conceived estimates of the scale of each economic activity. They are meant as planning level estimates only for the sole purpose of providing some context for the net benefit results shown in Table 6.

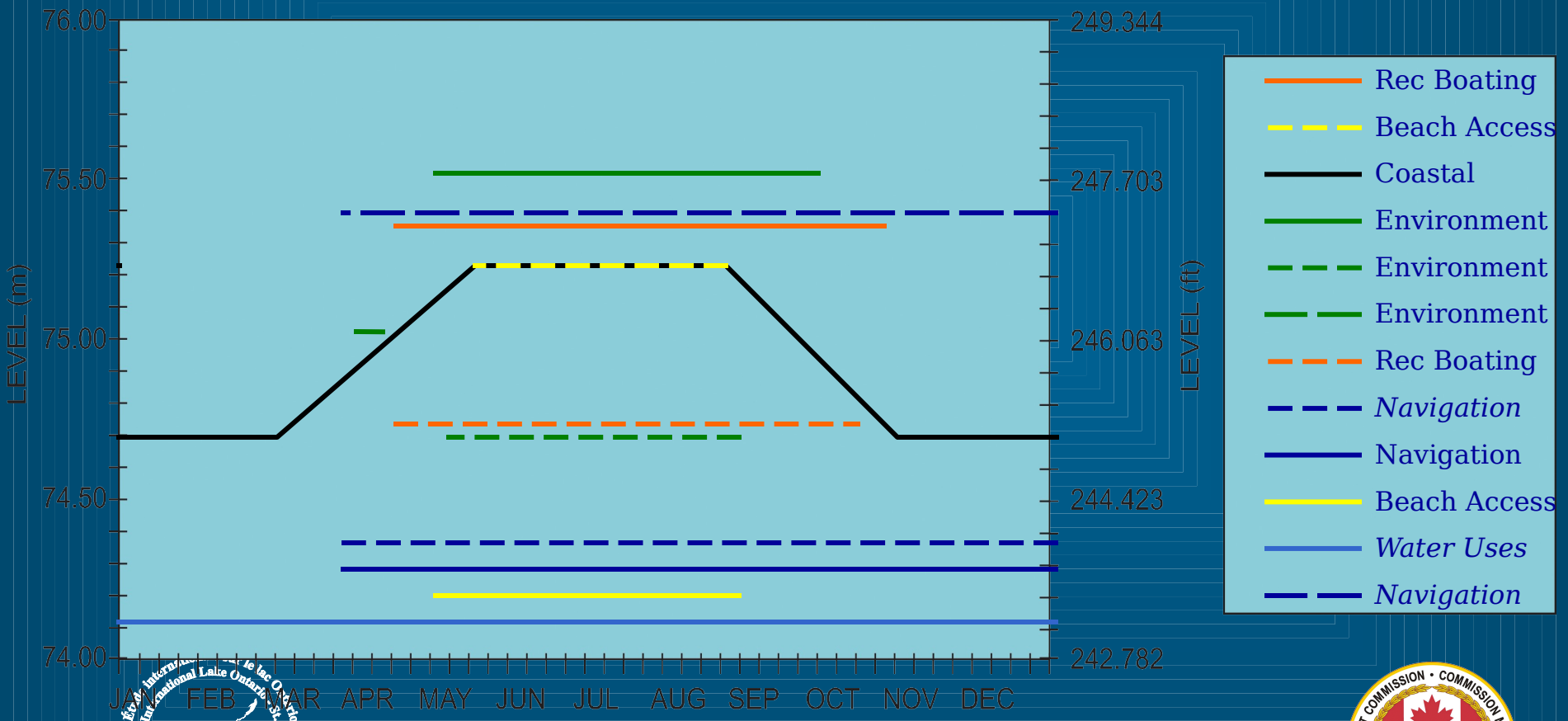
Table 8: Environmental Performance Indicator Results (Ratios) based on Historical Supplies

Environmental Performance Indicators	Plan A+	Plan B+	Plan D+	Plan E
Lake Ontario				
Wetland Meadow Marsh Community	1.02	1.44	1.17	1.56
Low Veg 18C - Spawning habitat supply	0.89	0.95	0.94	0.88
High Veg 24C - Spawning habitat supply	1.05	1.00	1.01	1.08
Low Veg 24C - Spawning habitat supply	1.00	1.02	1.00	1.11
Northern Pike – Young-of-year (YOY) recruitment	1.02	1.00	1.05	1.03
Largemouth Bass - YOY recruitment	0.94	0.98	0.97	0.96
Least Bittern (IXEX) - Reproductive index	0.88	1.04	0.95	1.13
Virginia Rail (RALI) - Reproductive index	0.96	1.11	0.99	1.15
Black Tern (CHNI) - Reproductive index	1.03	1.12	1.01	1.16
Yellow Rail (CONO) - Preferred breeding habitat	0.96	1.01	0.98	1.01
King Rail (RAEL) - Preferred breeding habitat	1.05	1.10	1.03	1.27
Upper River				
Low Veg 18C - Spawning habitat supply	1.01	1.01	1.01	1.04
High Veg 24C - Spawning habitat supply	1.03	1.01	1.02	1.02
Low Veg 24C - Spawning habitat supply	1.01	1.01	1.01	1.04
Northern Pike - YOY recruitment	1.05	1.03	1.01	1.06
Largemouth Bass - YOY recruitment	0.99	1.00	1.00	1.00
Northern Pike - YOY net productivity	4.02	2.08	1.17	4.08
Virginia Rail (RALI) - Reproductive index	1.16	1.27	1.31	1.33
Muskrat (ONZI) - House density in drowned river mouth wetlands	1.42	4.39	1.73	37.25
Lower River				
Golden Shiner - Suitable feeding habitat area	1.00	1.00	1.00	1.03
Wetlands Fish - Abundance index	0.87	0.90	0.84	0.97
Migratory Wildfowl - Habitat area	1.03	1.03	0.97	1.00
Least Bittern - Reproductive index	1.03	1.06	1.00	1.06
Virginia Rail (RALI) - Reproductive index	0.94	0.97	1.06	1.00
Migratory Wildfowl - Productivity	1.06	1.00	1.00	1.03
Black Tern (CHNI) - Reproductive index	0.84	0.77	1.00	0.77
Northern Pike (ESLU) - Reproductive area	0.97	0.94	0.94	0.94
Frog sp. - Reproductive habitat surface area	0.87	0.87	1.03	0.94
Eastern Sand Darter (AMPE) - Reproductive area	1.10	1.03	1.13	1.06
Spiny Softshell Turtle (APSP) - Reproductive habitat surface area	1.03	1.06	1.03	1.03
Bridle Shiner (NOBI) - Reproductive habitat surface area	1.00	0.97	1.00	1.03
Muskrat (ONZI) - Surviving houses	1.04	0.88	0.96	0.80
Percentage "good" scores for each plan	**9%**	**22%**	**16%**	**34%**
Overall Environmental Index	**1.06**	**1.35**	**1.10**	**4.04**

Table C3: Economic results by interest and region for the interest-specific and reference plans based on the historical supply sequence

	RecBoat	OntRip3	1998	1958D
Total	**-$20.55**	**-$8.07**	**-$0.03**	**-$40.91**
COASTAL	**-$1.77**	**$0.94**	**-$0.80**	**-$46.66**
Lake Ontario	*$0.74*	*$0.95*	*-$0.98*	*-$43.07*
Shore Protection Maintenance	$0.90	$0.77	-$0.97	-$20.04
Erosion to Unprotected Developed Parcels	-$0.16	$0.18	$0.00	-$0.12
Flooding	$0.00	$0.00	-$0.02	-$22.91
Upper St. Lawrence River	*$0.00*	*$0.00*	*$0.00*	*-$2.73*
Flooding	$0.00	$0.00	$0.00	-$2.73
St. Lawrence	*-$2.51*	*-$0.01*	*$0.18*	*-$0.85*
Flooding	-$2.46	-$0.08	$0.09	-$0.82
Shore Protection Maintenance	-$0.05	$0.07	$0.09	-$0.04
COMMERCIAL NAVIGATION	**-$3.91**	**$0.48**	**-$0.03**	**$2.97**
Lake Ontario	-$0.22	-$0.05	-$0.01	-$0.01
Seaway	-$3.04	$0.54	$0.01	$3.01
Montreal down	-$0.65	$0.00	-$0.03	-$0.03
HYDROPOWER	**-$18.72**	**-$3.90**	**-$0.45**	**$5.09**
NYPA-OPG	-$3.78	-$5.24	$0.02	$3.54
Hydro Quebec	-$14.94	$1.34	-$0.47	$1.55
RECREATIONAL BOATING	**$3.90**	**-$5.59**	**$1.05**	**-$2.51**
Above Dam	*$2.46*	*-$6.66*	*$1.02*	*-$2.82*
Lake Ontario	$2.14	-$4.57	$0.69	-$2.15
Alex Bay	$0.35	-$2.07	$0.30	-$0.67
Ogdensburg	$0.02	-$0.02	$0.01	-$0.06
Lake St. Lawrence	-$0.04	$0.01	$0.03	$0.06
Below Dam	*$1.44*	*$1.08*	*$0.04*	*$0.32*
Lac St. Louis	$0.80	$0.60	$0.10	$0.17
Montreal	$0.61	$0.39	-$0.03	$0.15
Lac St. Pierre	$0.03	$0.09	-$0.04	$0.00
M&I	**-$0.05**	**$0.00**	**$0.20**	**$0.20**
SL One-time infrastructure costs	-$0.05	$0.00	$0.00	$0.00
LSL Water Quality Investments	$0.00	$0.00	$0.20	$0.20

Considered Lake Ontario Water Levels



Recreational Boating and Related Tourism TWG

Four Areas of Work

Marinas / Launch Ramps

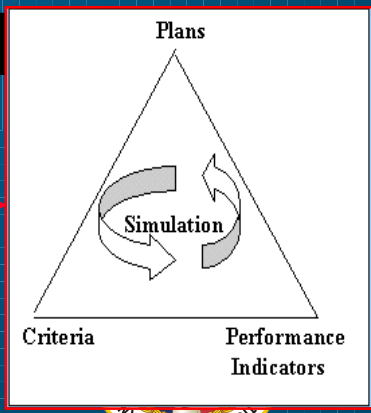
Boaters

Charterboats

Water Level-Impact Analysis

Economic Advisors

PFEG/SVM



Boater Survey Results

Boat Type	Boat Length	Marina Location	Typical Expenditures per day per group	WTP above current expenditures	days/year
Power & Sail	<16	All	$105	$65	23
Power	16-25	West	$185	$70	38
Power	16-25	Central	$162	$84	28
Power	16-25	East	$233	$67	35
Power	26-39	West	$156	$90	44
Power	26-39	Central	$245	$88	39
Power	26-39	East	$216	$91	43
Power	>=40	All	$106	$72	47
Sail	16-25	West	$125	$70	54
Sail	16-25	Central	$110	$84	40
Sail	16-25	East	$158	$67	50
Sail	26-39	West	$106	$90	63
Sail	26-39	Central	$166	$88	55
Sail	26-39	East	$146	$91	61
Sail	>=40	All	$72	$72	66

Étude internationale sur le lac Ontario et le fleuve Saint-Laurent
International Lake Ontario - St. Lawrence River Study

Table B-2: Ideal Criteria for Water Levels by Reach for Recreational Boating Interests for the Boating Season 15 April through 15 October. (Chart datum is shown for reference.)*

Study Reach	Chart Datum		Ideal Level		Minimum Level		Maximum Level	
	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft)	(m)
Lake Ontario	243.3	74.3	246.2	75.04	244.8	74.61	247.6	75.46
Alex Bay	243.0	74.1	245.8	74.92	244.4	74.48	247.2	75.34
Ogdensburg	242.5	73.9	245.1	74.70	243.7	74.27	246.5	75.13
Lac St. Louis	66.9	20.4	70.5	21.5	68.6	20.9	74.8	22.8
Lac St. Pierre	12.5	3.8	14.8	4.5	13.9	4.25	17.1	5.2
Montreal - Contrecoeur	15.7	4.8	21.3	6.5	18.0	5.5	32.8	10.0

* It should be noted that these criteria were established before the Ogdensburg reach was divided into two reaches. New criteria were not established for the new reaches, because the work group had been disbanded by that time. Thus, the Ogdensburg criteria should be ignored in Table B-2.

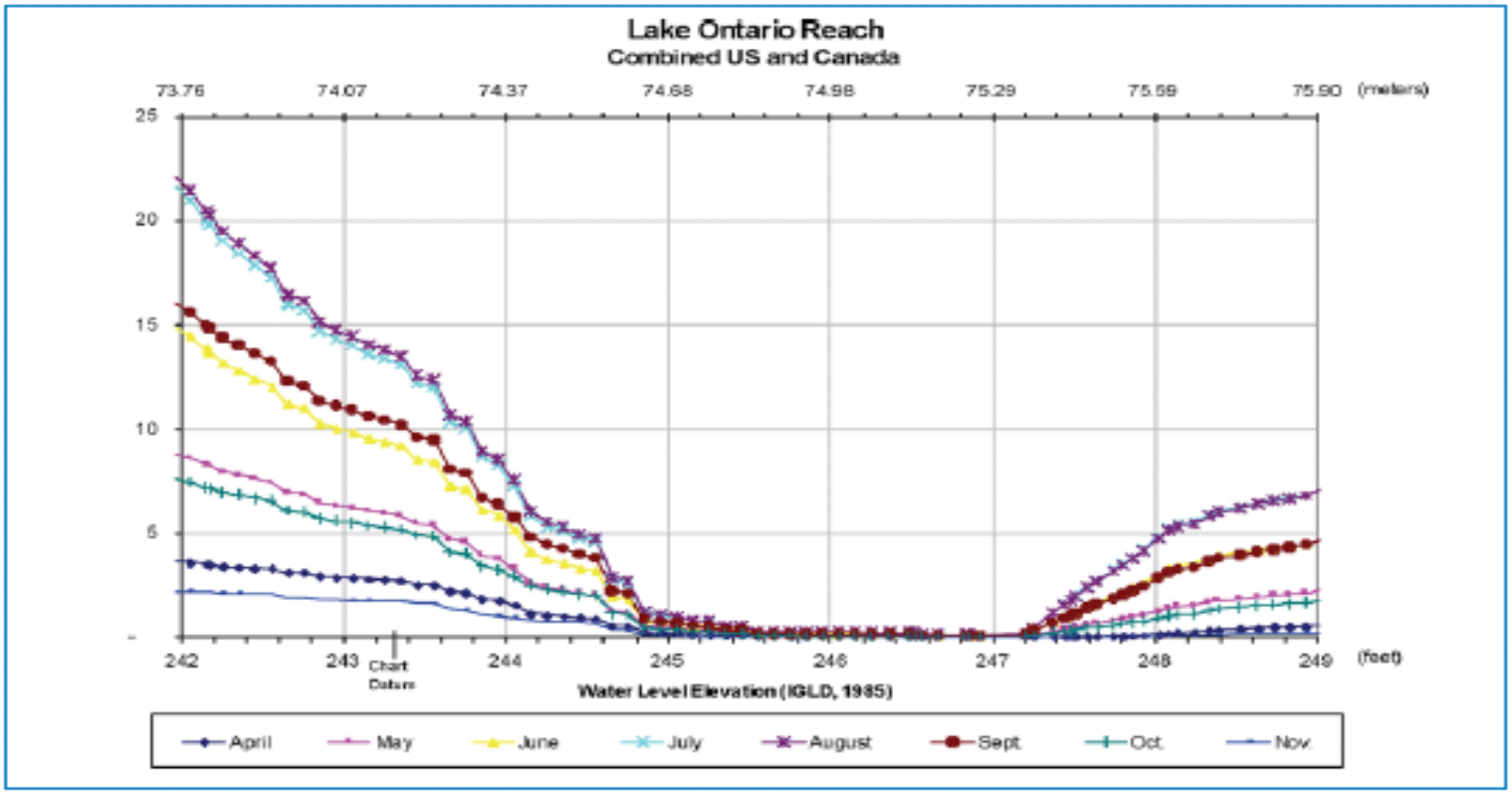
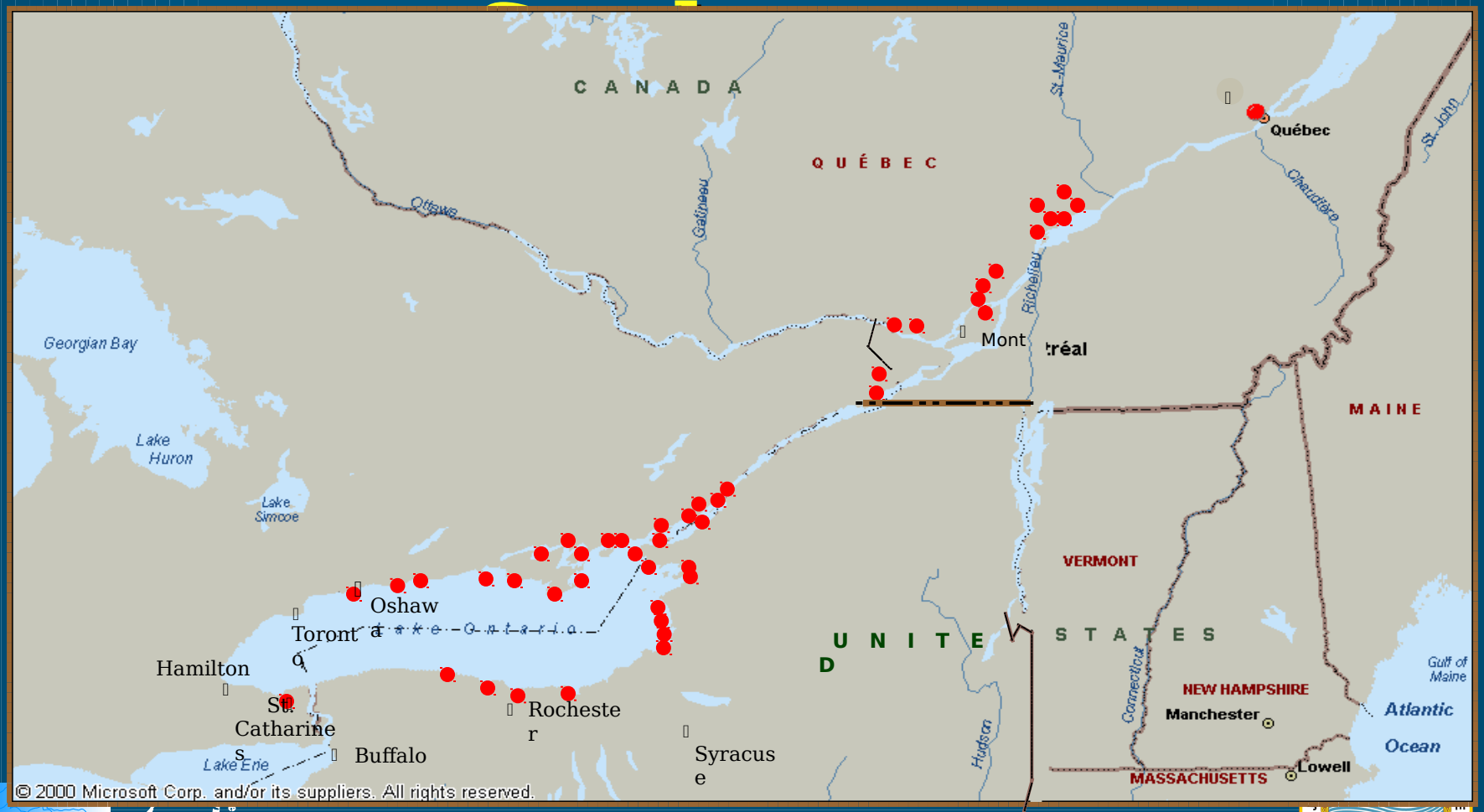
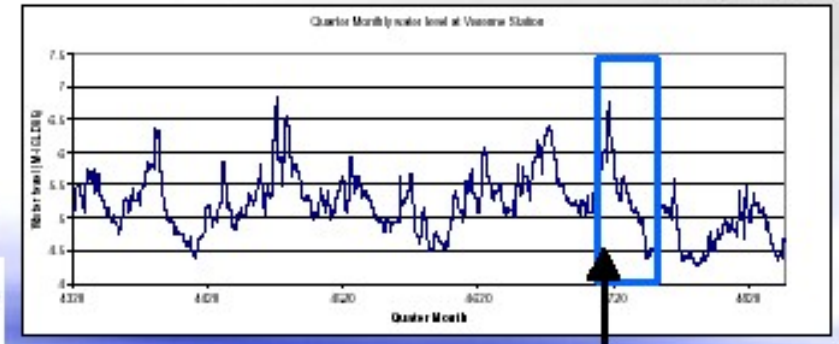


Figure B-2: Lake Ontario Reach

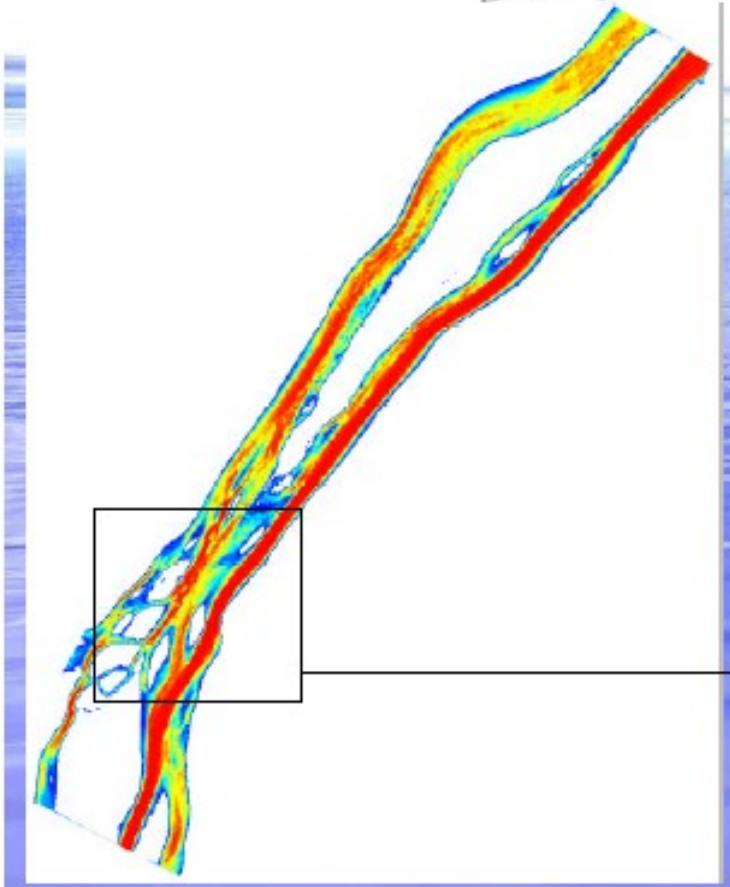
32 Wetland sites studied by the LOSLR

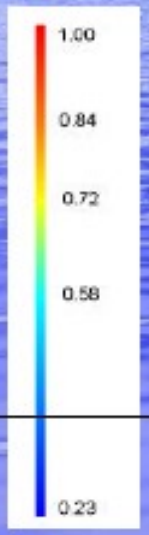


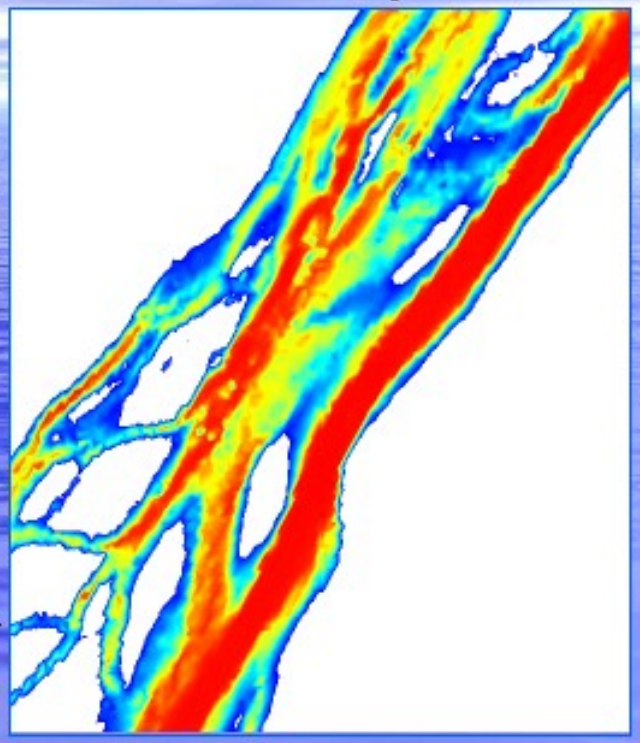
Fish habitat IS Curve results
(Lake sturgeon *Acipenser fulvescens*)
1998, quarter-monthly IS Curve results
temporal evolution



IS Habitat







Adapted from: Mingelbier, Brodeur et Morin (2003)